

PERSONAL CARE COMPOSITION CONTAINING A
CATIONIC CELLULOSE POLYMER AND AN ANIONIC SURFACTANT SYSTEM

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CROSS REFERENCE TO RELATED APPLICATION

The application claims the benefit of US Provisional application Serial No. 60/441,066
(Case 9144P), filed on January 17, 2003, and US Utility application Serial No. 10/464,171 (Case
8979) filed on June 18, 2003.

FIELD

The present invention relates to a personal care composition containing a cationic
cellulose polymer and an anionic surfactant system. More specifically, it relates to a personal care
composition containing an anionic surfactant system with specific ratios of ethoxylate and sulfate
such that when combined with the cationic cellulose polymer, maximized levels of coacervate are
achieved in use.

BACKGROUND

Personal care compositions comprising various combinations of deterative surfactant and
conditioning agents are known. These products typically comprise an anionic deterative surfactant
in combination with a conditioning agent such as silicone, hydrocarbon oil, fatty esters, or
combinations thereof. These products have become more popular among consumers as a means
of conveniently obtaining hair and skin conditioning and cleansing performance all from a single
personal care product.

However, many personal care compositions do not provide sufficient deposition of
conditioning agents onto hair and skin during the cleansing process. Without such deposition,
large proportions of conditioning agent are rinsed away during the cleansing process and therefore
provide little or no conditioning benefit. Without sufficient deposition of the conditioning agent
on the hair and skin, relatively high levels of conditioning agents may be needed in the personal
cleansing composition to provide adequate conditioning performance. However, high levels of a
conditioning agent can increase raw material costs, reduce lathering, and present product stability
concerns.

Obtaining good deposition of a conditioning agent is further complicated by the action of
deterative surfactants in the personal care composition. Deterative surfactants are designed to carry

away or remove oil, grease, dirt, and particulate matter from the hair and skin. In doing so, the
detergent surfactants can also interfere with deposition of the conditioning agent, and both
deposited and non deposited conditioning agent can be removed during rinsing. This further
reduces deposition of the conditioning agent onto the hair and skin after rinsing, thus further
reducing conditioning performance.

One known method for improving deposition of a conditioning agent involves the use of
certain cationic deposition polymers. These polymers may be synthetic or natural cellulosic or
guar polymers that have been modified with cationic substituents. The cationic charge density of
such polymers, especially when used in a personal care composition, is minimized so as to avoid
incompatibility with anionic materials in the product such as anionic surfactant. Thus, most
personal care compositions that contain both an anionic detergent surfactant and a cationic
deposition polymer have a relatively low level of coacervate conditioning. A need still exists for
improved conditioning performance in personal care compositions.

SUMMARY

The present invention is directed to a personal care composition comprising:

- a. from about 0.01 to about 5 wt.% of a cationic cellulose polymer, wherein said
cationic cellulose polymer has a molecular weight of at least 800,000;
- b. from about 5 to about 50 wt.% of an anionic surfactant system having an
ethoxylate level and a sulfate level,
 - i. wherein said ethoxylate level is in the amount of 1.04 multiplied by the
molecular weight of said cationic cellulose polymer divided by
1,000,000 plus from about 0.75 to about 3.25,
 - ii. wherein said sulfate level is in the amount of 0.42 multiplied by the
charge density of said cationic cellulose polymer plus from about 1.1 to
about 3.6;
- c. from about 0.01 to about 5 wt.% of a mono or divalent salt; and
- d. at least about 20 wt.% of an aqueous carrier.

Alternatively, the present invention is directed to a personal care composition with a
percent transmittance at 600nm of $\geq 70\%$ or a personal care composition with a cationic cellulose
polymer having a molecular weight of at least 500,000 additionally comprising from about 0.01 to
about 10 wt.% of a microemulsified oil having a particle size of $\leq 80\text{nm}$.

The present invention is further directed to a method of using the personal care
composition.

These and other features, aspects, and advantages of the present invention will become evident to those skilled in the art from a reading of the present disclosure.

DETAILED DESCRIPTION

5 While the specification concludes with claims that particularly point out and distinctly claim the invention, it is believed the present invention will be better understood from the following description.

The personal care compositions of the present invention include a cationic cellulose polymer, an anionic surfactant system, a salt, and water. Each of these essential components, as
10 well as preferred or optional components, are described in detail hereinafter.

All percentages, parts and ratios are based upon the total weight of the compositions of the present invention, unless otherwise specified. All such weights as they pertain to listed ingredients are based on the active level and, therefore, do not include solvents or by-products that may be included in commercially available materials, unless otherwise specified. The term
15 "weight percent" may be denoted as "wt.%" herein.

All molecular weights as used herein are weight average molecular weights expressed as grams/mole, unless otherwise specified.

The term "charge density", as used herein, refers to the ratio of the number of positive charges on a monomeric unit of which a polymer is comprised to the molecular weight of said
20 monomeric unit. The charge density multiplied by the polymer molecular weight determines the number of positively charged sites on a given polymer chain.

Herein, "comprising" means that other steps and other ingredients which do not affect the end result can be added. This term encompasses the terms "consisting of" and "consisting essentially of". The compositions and methods/processes of the present invention can comprise,
25 consist of, and consist essentially of the essential elements and limitations of the invention described herein, as well as any of the additional or optional ingredients, components, steps, or limitations described herein.

The term "polymer" as used herein shall include materials whether made by polymerization of one type of monomer or made by two (*i.e.*, copolymers) or more types of
30 monomers.

The term "solid particle" as used herein means a particle that is not a liquid or a gas.

The term "water soluble" as used herein, means that the polymer is soluble in water in the present composition. In general, the polymer should be soluble at 25° C at a concentration of 0.1% by weight of the water solvent, preferably at 1%, more preferably at 5%, most preferably at
35 15%.

The term “water insoluble” as used herein, means that the polymer is not soluble in water in the present composition. Thus, the polymer is not miscible with water.

The transparency of the composition is measured using Ultra-Violet/Visible (UV/VIS) Spectrophotometry, which determines the absorption or transmission of UV/VIS light by a sample. A light wavelength of 600 nm has been shown to be adequate for characterizing the degree of clarity of cosmetic compositions. Typically, it is best to follow the specific instructions relating the specific spectrophotometer being used. In general, the procedure for measuring percent transmittance starts by setting the spectrophotometer to the 600 nm. Then a calibration “blank” is run to calibrate the readout to 100 percent transmittance. The test sample is then placed in a cuvette designed to fit the specific spectrophotomer and the percent transmittance is measured by the spectrophotomer at 600nm.

All cited references are incorporated herein by reference in their entireties. Citation of any reference is not an admission regarding any determination as to its availability as prior art to the claimed invention.

While both the surfactant composition and polymer characteristics are known to impact conditioning efficacy, the known art focuses on the polymer properties and fails to teach any specific surfactant composition. Moreover, the art generally teaches away from specific surfactant compositions and generally lists a broad range of suitable surfactants from which the composition may be selected.

One embodiment of the present invention concerns the surprising discovery that compositions combining certain specific levels and ratios of surfactant as described by the overall sulfate and ethoxylation values (described herein) maximize the conditioning benefit via maximization of coacervate formation. Moreover, while the optimum surfactant blend is different for each polymer, the authors have discovered that the optimum surfactant composition can be described by two parameters. These parameters include sulfate and ethoxylation values that when expressed as a function of the polymer’s charge density and molecular weight maximize the formation of coacervate.

Coacervates, without being limited to a particular theory, provide improved hair and skin conditioning without any additional conditioning actives. Further, when dispersed conditioning agent droplets are added to the matrix, the coacervate provides an improved mechanism for conditioning agent deposition, yielding conditioning agent deposition that results in even more of a conditioning benefit.

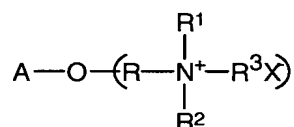
A. Cationic Cellulose Polymer

The composition of the present invention includes a cationic cellulose polymer of sufficiently high molecular weight to effectively enhance the deposition of the personal care

composition described herein. The average molecular weight of such suitable cationic cellulose polymers will generally be between about 500,000 and 10 million, preferably between about 800,000 and about 5 million, still more preferably between 1 million and 2.5 million. Suitable cationic cellulose polymers will have cationic charge densities of at least about 0.5 meq/gm, at the pH of intended use of the personal care composition, which pH will generally range from about pH 3 to about pH 9, preferably between about pH 4 and about pH 8. The "cationic charge density" of a polymer, as that term is used herein, refers to the ratio of the number of positive charges on a monomeric unit of which the polymer is comprised to the molecular weight of said monomeric unit.

The concentration of the cationic polymer in the personal care composition ranges from about 0.01% to about 5.0%, preferably from about 0.05% to about 3.0% by weight of the personal care composition.

Suitable cationic cellulose polymers include those which conform to the Formula I:



wherein A is an anhydroglucose residual group, such as a cellulose anhydroglucose residual; R is an alkylene oxyalkylene, polyoxyalkylene, or hydroxyalkylene group, or combination thereof; R¹, R², and R³ independently are alkyl, aryl, alkylaryl, arylalkyl, alkoxyalkyl, or alkoxyaryl groups, each group containing up to about 18 carbon atoms, and the total number of carbon atoms for each cationic moiety (i.e., the sum of carbon atoms in R¹, R² and R³) preferably being about 20 or less; and X is an anionic counterion. Any anionic counterions can be use in association with the cationic polymers of the present invention so long as the polymers remain soluble in water, in the personal care composition, or in a coacervate phase of the personal care composition, and so long as the counterions are physically and chemically compatible with the essential components of the personal care composition or do not otherwise unduly impair product performance, stability or aesthetics. Non limiting examples of such counterions include halides (e.g., chlorine, fluorine, bromine, iodine), sulfate and methylsulfate. The degree of cationic substitution in these polysaccharide polymers is typically from about 0.01-1 cationic groups per anhydroglucose unit.

Preferred cationic cellulose polymers are salts of hydroxyethyl cellulose reacted with trimethyl ammonium substituted epoxide, referred to in the industry (CTFA) as Polyquaternium 10 and available from Amerchol Corp. (Edison, N.J., USA).

The cationic cellulose polymers herein are either soluble in the personal care composition or are soluble in a complex coacervate phase in the personal care composition formed by the cationic cellulose polymer and the anionic surfactant component described herein. Complex coacervates of the cationic cellulose polymer can also be formed with other charged materials in the personal care composition.

Coacervate formation is dependent upon a variety of criteria such as molecular weight, component concentration, and ratio of interacting ionic components, ionic strength (including modification of ionic strength, for example, by addition of salts), charge density of the cationic and anionic components, pH, and temperature. Coacervate systems and the effect of these parameters have been described, for example, by J. Caelles, et al., "Anionic and Cationic Compounds in Mixed Systems", *Cosmetics & Toiletries*, Vol. 106, April 1991, pp 49-54; C. J. van Oss, "Coacervation, Complex-Coacervation and Flocculation", *J. Dispersion Science and Technology*, Vol. 9 (5,6), 1988-89, pp 561-573, and D. J. Burgess, "Practical Analysis of Complex Coacervate Systems", *J. of Colloid and Interface Science*, Vol. 140, No. 1, November 1990, pp 227-238, which descriptions are incorporated herein by reference.

It is believed to be particularly advantageous for the cationic cellulose polymer to be present in the personal care composition in a coacervate phase, or to form a coacervate phase upon application or rinsing of the personal care composition to or from the hair. Complex coacervates are believed to more readily deposited on the hair. Thus, in general, it is preferred that the cationic cellulose polymer exist in the personal care composition as a coacervate phase or form a coacervate phase upon dilution.

Techniques for analysis of formation of complex coacervates are known in the art. For example, microscopic analyses of the personal care compositions, at any chosen stage of dilution, can be utilized to identify whether a coacervate phase has formed. Such coacervate phase will be identifiable as an additional emulsified phase in the composition. The use of dyes can aid in distinguishing the coacervate phase from other insoluble phases dispersed in the personal care composition. In clear compositions, a spectrophotometer can also help determine at which dilution ratio(s) of water to personal care composition, the coacervate is most prevalent. For example, percent transmittance values measured of the dilution that are less than 85% are indicative of significant coacervate formation. As percent transmittance values measured of the dilution decrease, typically higher levels of coacervate are formed.

Centrifuging the diluted personal care composition and measuring coacervate gravimetrically is an alternate quantitative technique applicable to opaque or clear compositions, and particularly advantageous in analyzing opaque products. Herein, several different dilutions were made in a 50ml centrifuge tube and centrifuged for 20 minutes at 9200rpm using a Beckman

Couller TJ25 centrifuge. The supernatant is then removed and the remaining settled coacervate assessed gravimetrically. A blank (shampoo without polymer) is run to establish a base line. The values are calculated for each dilution and the peak amount reported from this method is referred herein as via the coacervate centrifuge method.

5 **B. Anionic Surfactant System - Ethoxylate and Sulfate**

 The personal care composition of the present invention includes an anionic surfactant. The surfactant component is included to provide cleaning performance to the composition. The surfactant component in turn comprises an ethoxylated surfactant and a sulfate, and optionally a zwitterionic or amphoteric surfactant, an additional surfactant, or a combination thereof. Such
10 surfactants should be physically and chemically compatible with the essential components described herein, or should not otherwise unduly impair product stability, aesthetics or performance.

 Suitable anionic surfactant components for use in the personal care composition herein include those that are known for use in hair care or other personal care compositions. The
15 concentration of the anionic surfactant component in the personal care composition should be sufficient to provide the desired cleaning and lather performance, and generally range from about 5% to about 50%, preferably from about 8% to about 30%, more preferably from about 10% to about 25%, by weight of the composition.

 In considering the performance characteristics of coacervate generation, wet conditioning
20 performance, dry conditioning performance, and conditioning ingredient deposition on hair, the present inventors discovered that in order to maximize the performance potential of polymer systems, it is necessary to optimize the levels and types of surfactant. The present inventors discovered that systems with ethoxylated and non-ethoxylated surfactants having a ratio of greater than 2:1 ethoxylated:non-ethoxylated surfactants had preferred performance, wherein the
25 ethoxylated surfactants had greater than 2 moles of ethoxylation. The present inventors further discovered that in order to maximize the performance potential of polymer systems, it is necessary to optimize the levels of ethoxylate and sulfate. In order to do this, the aforementioned performance characteristics were plotted versus ethoxylate levels and versus sulfate levels. The "peak" or optimal level of sulfate and ethoxylate was then plotted versus a variety of chemical
30 descriptors for cationic polymeric structures including molecular weight and charge density. The present inventors discovered that clear correlations existed with $R^2 > 0.8$, when the optimal level of ethoxylate providing peak performance was plotted as the "y" axis versus polymer molecular weight divided by 1,000,000 as the "x" axis. The equation of that line showed that the slope of the line was equal to approximately 1.04 and the intercept fell between from about 0.75 to about
35 3.25. Preferably the intercept is greater than 0.75, still preferably greater than 1.25, and still

preferably greater than 1.75. Preferably the intercept is less than 3.25, still preferably less than 2.75, and still preferably less than 2.25. Thus, for any given molecular weight cationic cellulose polymer, an optimum ethoxylate level could be calculated. Additionally, a second correlation was developed where the optimal level of sulfate was plotted as the "y" axis and charge density was plotted as the "x" axis. Again, a relatively straight line was realized where the slope of the line was equal to approximately 0.42 and the intercept fell between from about 1.1 to about 3.6. Preferably, the intercept is greater than 1.1, still preferably greater than 1.6, and still preferably greater than 2.1. Preferably, the intercept is less than 3.6, still preferably less than 3.1, and still preferably less than 2.6. This discovery was surprising and explained how to maximize the performance of various polymers, particularly those polymers with molecular weights ranging from 500,000 to 2,000,000.

Thus, a percent ethoxylate can be calculated based on the stoichiometry of the surfactant structure, based on a particular molecular weight of the surfactant where the number of moles of ethoxylation is known. Likewise, given a specific molecular weight of a surfactant and a sulfation reaction completion measurement, the percent sulfate can be calculated. Analytical techniques have been developed to measure percent ethoxylation or percent sulfates within surfactant systems. The level of ethoxylate and the level of sulfate representative of a particular surfactant system is calculated from the percent ethoxylation and percent sulfates of individual surfactants in the following manner:

Level of Ethoxylate in a composition = percent ethoxylation multiplied by percent active ethoxylated surfactant.

Level of Sulfate in a composition = percent Sulfate in ethoxylated surfactant multiplied by percent active ethoxylated surfactant plus percent sulfate in non-ethoxylated surfactant multiplied by percent active non-ethoxylated surfactant.

Sample Calculation:

Example 1 shows an ethoxylated surfactant that contains 0.294321% ethoxylate and a 0.188307% sulfate level and a non-ethoxylated surfactant with a percent sulfate of 0.266845. Both surfactants are 29% active.

Level of Ethoxylate in Example 1 = 0.294321 multiplied by 10 (% active ethoxylated surfactant). Thus the level of ethoxylate in Example 1's composition is approximately 2.94.

Level of Sulfate in Example 1 = 0.18830 multiplied by 10 (% active ethoxylated surfactant) plus 0.266845 multiplied by 4 (% active non-ethoxylated surfactant). Thus the level of sulfate in Example 1's composition is approximately 2.95.

Preferred anionic surfactants suitable for use in the personal care compositions are the alkyl sulfates and alkyl ether sulfates. These materials have the respective formulae ROSO_3M and $\text{RO}(\text{C}_2\text{H}_4\text{O})_x\text{SO}_3\text{M}$, wherein R is alkyl or alkenyl of from about 8 to about 18 carbon atoms, x is an integer having a value of from about 1 to about 10, and M is a cation such as ammonium, alkanolamines, such as triethanolamine, monovalent metals, such as sodium and potassium, and polyvalent metal cations, such as magnesium, and calcium. Solubility of the surfactant will depend upon the particular anionic surfactants and cations chosen.

Preferably, R has from about 8 to about 18 carbon atoms, more preferably from about 10 to about 16 carbon atoms, even more preferably from about 12 to about 14 carbon atoms, in both the alkyl sulfates and alkyl ether sulfates. The alkyl ether sulfates are typically made as condensation products of ethylene oxide and monohydric alcohols having from about 8 to about 24 carbon atoms. The alcohols can be synthetic or they can be derived from fats, e.g., coconut oil, palm kernel oil, tallow. Lauryl alcohol and straight chain alcohols derived from coconut oil or palm kernel oil are preferred. Such alcohols are reacted with between from about 0 and about 10, preferably from about 2 to about 5, more preferably from about 3, molar proportions of ethylene oxide, and the resulting mixture of molecular species having, for example, an average of 3 moles of ethylene oxide per mole of alcohol, is sulfated and neutralized.

Specific non limiting examples of alkyl ether sulfates which may be used in the personal care compositions of the present invention include sodium and ammonium salts of coconut alkyl triethylene glycol ether sulfate, tallow alkyl triethylene glycol ether sulfate, and tallow alkyl hexaoxyethylene sulfate. Highly preferred alkyl ether sulfates are those comprising a mixture of individual compounds, wherein the compounds in the mixture have an average alkyl chain length of from about 10 to about 16 carbon atoms and an average degree of ethoxylation of from about 1 to about 4 moles of ethylene oxide. Such a mixture also comprises from about 0 to 20% by weight C_{12-13} compounds; from 60 to 100% by weight of $\text{C}_{14-15-16}$ compounds; from about 0 to 20% by weight of $\text{C}_{17-18-19}$ compounds; from about 3 to 30% by weight of compounds having a degree of ethoxylation of 0; from about 45 to 90% by weight of compounds having a degree of ethoxylation of from 1 to 4; from about 10 to 25% by weight of compounds having a degree of ethoxylation of from 4 to 8; and from about 0.1 to 15% by weight of compounds having a degree of ethoxylation greater than 8.

Another suitable class of anionic surfactants are the water-soluble salts of the organic, sulfuric acid reaction products of the general formula $R_1\text{-SO}_3\text{-M}$ wherein R_1 is chosen from the group consisting of a straight or branched chain, saturated aliphatic hydro-carbon radical having from 8 to 24, preferably 12 to 18, carbon atoms; and M is a cation. Important examples are the salts of an organic sulfuric acid reaction product of a hydrocarbon of the methane series, including iso-, neo-, ineso-, and n-paraffins, having 8 to 24 carbon atoms, preferably 12 to 18 carbon atoms, and a sulfonating agent e.g., SO_3 , H_2SO_4 , oleum, obtained according to known sulfonation methods, including bleaching and hydrolysis. Preferred are alkali metal and ammonium sulfonated C_{12-18} -n-paraffins.

Preferred anionic surfactants for use in the personal care compositions include ammonium lauryl sulfate, ammonium laureth sulfate, triethylamine lauryl sulfate, triethylamine laureth sulfate, triethanolamine lauryl sulfate, triethanolamine laureth sulfate, monoethanolamine lauryl sulfate, monoethanolamine laureth sulfate, diethanolamine lauryl sulfate, diethanolamine laureth sulfate, lauric monoglyceride sodium sulfate, sodium lauryl sulfate, sodium laureth sulfate, potassium lauryl sulfate, potassium laureth sulfate, sodium lauryl sarcosinate, sodium lauroyl sarcosinate, lauryl sarcosine, cocoyl sarcosine, ammonium cocoyl sulfate, ammonium lauroyl sulfate, sodium cocoyl sulfate, sodium lauroyl sulfate, potassium cocoyl sulfate, potassium lauryl sulfate, triethanolamine lauryl sulfate, triethanolamine lauryl sulfate, monoethanolamine cocoyl sulfate, monoethanolamine lauryl sulfate, and combinations thereof.

C. Additional Surfactants

1. Zwitterionic or Amphoteric Surfactant

Suitable amphoteric or zwitterionic surfactants for use in the personal care composition herein include those which are known for use in hair care or other personal care compositions. Concentration of such amphoteric surfactants preferably ranges from about 0.5% to about 20%, preferably from about 1% to about 10%, by weight of the composition. Non limiting examples of suitable zwitterionic or amphoteric surfactants are described in U.S. Pat. Nos. 5,104,646 (Bolich Jr. et al.), 5,106,609 (Bolich Jr. et al.), which descriptions are incorporated herein by reference.

Amphoteric surfactants suitable for use in the personal care composition are well known in the art, and include those surfactants broadly described as derivatives of aliphatic secondary and tertiary amines in which the aliphatic radical can be straight or branched chain and wherein one of the aliphatic substituents contains from about 8 to about 18 carbon atoms and one contains an anionic water solubilizing group such as carboxy, sulfonate, sulfate, phosphate, or phosphonate. Preferred amphoteric surfactants for use in the present invention include cocoamphoacetate, cocoamphodiacetate, lauroamphoacetate, lauroamphodiacetate, and mixtures thereof.

Zwitterionic surfactants suitable for use in the personal care composition are well known in the art, and include those surfactants broadly described as derivatives of aliphatic quaternary ammonium, phosphonium, and sulfonium compounds, in which the aliphatic radicals can be straight or branched chain, and wherein one of the aliphatic substituents contains from about 8 to about 18 carbon atoms and one contains an anionic group such as carboxy, sulfonate, sulfate, phosphate or phosphonate. Zwitterionics such as betaines are preferred.

2. Optional Surfactants

The personal care compositions of the present invention may further comprise additional surfactants for use in combination with the surfactant component described hereinbefore. Other suitable anionic surfactants are the water-soluble salts of organic, sulfuric acid reaction products conforming to the formula $[R^1-SO_3-M]$ where R^1 is a straight or branched chain, saturated, aliphatic hydrocarbon radical having from about 8 to about 24, preferably from about 10 to about 18, carbon atoms; and M is a cation described hereinbefore. Non limiting examples of such surfactants are the salts of an organic sulfuric acid reaction product of a hydrocarbon of the methane series, including iso-, neo-, and n-paraffins, having from about 8 to about 24 carbon atoms, preferably about 12 to about 18 carbon atoms and a sulfonating agent, e.g., SO_3 , H_2SO_4 , obtained according to known sulfonation methods, including bleaching and hydrolysis. Preferred are alkali metal and ammonium sulfonated C_{10} to C_{18} n-paraffins.

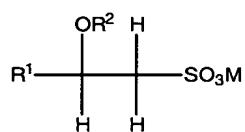
Still other suitable anionic surfactants are the reaction products of fatty acids esterified with isethionic acid and neutralized with sodium hydroxide where, for example, the fatty acids are derived from coconut oil or palm kernel oil; sodium or potassium salts of fatty acid amides of methyl tauride in which the fatty acids, for example, are derived from coconut oil or palm kernel oil. Other similar anionic surfactants are described in U.S. Pat. Nos. 2,486,921; 2,486,922; and 2,396,278, which descriptions are incorporated herein by reference.

Other anionic surfactants suitable for use in the personal care compositions are the succinates, examples of which include disodium N-octadecylsulfosuccinnate; disodium lauryl sulfosuccinate; diammonium lauryl sulfosuccinate; tetrasodium N-(1,2-dicarboxyethyl)-N-octadecylsulfosuccinnate; diamyl ester of sodium sulfosuccinic acid; dihexyl ester of sodium sulfosuccinic acid; and dioctyl esters of sodium sulfosuccinic acid.

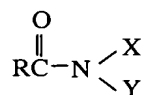
Other suitable anionic surfactants include olefin sulfonates having about 10 to about 24 carbon atoms. In this context, the term "olefin sulfonates" refers to compounds which can be produced by the sulfonation of alpha-olefins by means of uncomplexed sulfur trioxide, followed by neutralization of the acid reaction mixture in conditions such that any sulfonates which have been formed in the reaction are hydrolyzed to give the corresponding hydroxy-alkanesulfonates.

The sulfur trioxide can be liquid or gaseous, and is usually, but not necessarily, diluted by inert diluents, for example by liquid SO₂, chlorinated hydrocarbons, etc., when used in the liquid form, or by air, nitrogen, gaseous SO₂, etc., when used in the gaseous form. The alpha-olefins from which the olefin sulfonates are derived are mono-olefins having from about 10 to about 24 carbon atoms, preferably from about 12 to about 16 carbon atoms. Preferably, they are straight chain olefins. In addition to the true alkene sulfonates and a proportion of hydroxy-alkanesulfonates, the olefin sulfonates can contain minor amounts of other materials, such as alkene disulfonates depending upon the reaction conditions, proportion of reactants, the nature of the starting olefins and impurities in the olefin stock and side reactions during the sulfonation process. A non limiting example of such an alpha-olefin sulfonate mixture is described in U.S. Patent 3,332,880, which description is incorporated herein by reference.

Another class of anionic surfactants suitable for use in the personal care compositions are the beta-alkyloxy alkane sulfonates. These surfactants conform to the Formula II:



- where R¹ is a straight chain alkyl group having from about 6 to about 20 carbon atoms, R² is a lower alkyl group having from about 1 to about 3 carbon atoms, preferably 1 carbon atom, and M is a water-soluble cation as described hereinbefore. Preferred anionic surfactants for use in the personal care compositions include sodium tridecyl benzene sulfonate, sodium dodecyl benzene sulfonate.
- Amides, including alkanol amides, are the condensation products of fatty acids with primary and secondary amines or alkanolamines to yield products of the general Formula III:



- wherein RCO is a fatty acid radical and R is C₈₋₂₀; X is an alkyl, aromatic or alkanol (CHR'CH₂OH wherein R' is H or C₁₋₆ alkyl); Y is H, alkyl, alkanol or X. Suitable amides include, but are not limited to cocamide, lauramide, oleamide and stearamide. Suitable alkanolamides include, but are not limited to, cocamide DEA, cocamide MEA, cocamide MIPA, isostearamide DEA, isostearamide MEA, isostearamide MIPA, lanolinamide DEA, lauramide DEA, lauramide MEA, lauramide MIPA, linoleamide DEA, linoleamide MEA, linoleamide MIPA, myristamide DEA, myristamide MEA, myristamide MIPA, Oleamide DEA, Oleamide MEA, Oleamide MIPA, palmamide DEA, palmamide MEA, palmamide MIPA, palmitamide

DEA, palmitamide MEA, palm kernelamide DEA, palm kernelamide MEA, palm kernelamide MIPA, peanutamide MEA, peanutamide MIPA, soyamide DEA, stearamide DEA, stearamide MEA, stearamide MIPA, tallamide DEA, tallowamide DEA, tallowamide MEA, undecylenamide DEA, undecylenamide MEA. The condensation reaction may be carried out with free fatty acids or with all types of esters of the fatty acids, such as fats and oils, and particularly methyl esters. The reaction conditions and the raw material sources determine the blend of materials in the end product and the nature of any impurities.

Suitable optional surfactants include nonionic surfactants. Any such surfactant known in the art for use in hair or personal care products may be used, provided that the optional additional surfactant is also chemically and physically compatible with the essential components of the personal care composition, or does not otherwise unduly impair product performance, aesthetics or stability. The concentration of the optional additional surfactants in the personal care composition may vary with the cleansing or lather performance desired, the optional surfactant selected, the desired product concentration, the presence of other components in the composition, and other factors well known in the art.

Non limiting examples of other surfactants suitable for use in the personal care compositions are described in McCutcheon's, Emulsifiers and Detergents, 1989 Annual, published by M. C. Publishing Co., and U.S. Pat. Nos. 3,929,678, 2,658,072; 2,438,091; 2,528,378, which descriptions are incorporated herein by reference.

D. Mono or Divalent Salt

The personal care compositions of the present invention may further comprise a mono or divalent salt, which acts as a source of entropy in order to act as a coacervate initiator. Salt allows more contacts to be made between the polymer and surfactant, which increases the formation of coacervates. By the term "coacervate initiator", as used herein, means electrolytes capable of inducing the formation of coacervates when combined with compositions comprising an anionic deterative surfactant component surfactant system and the synthetic cationic polymer.

Surfactant salts themselves are not included in the present electrolyte definition but other salts are. Suitable salts include, but are not limited to chlorides, phosphates, sulfates, nitrates, citrates and halides. The counter ions of such salts can be, but are not limited to, sodium, potassium, ammonium, magnesium, zinc or other mono and divalent cation. Electrolytes most preferred for use in the compositions of the present invention include sodium chloride, ammonium chloride, sodium citrate, magnesium chloride, and magnesium sulfate. It is recognized that these salts may serve as thickening aids or buffering aids in addition to their role as a coacervate initiator. The amount of coacervate initiator comprising the electrolyte and/or the optional surfactant will vary with the type of surfactant and polymer, but is preferably present at a level of

from about 0.01% to about 5%, more preferably from about 0.05% to about 3.5%, and still more preferably from about 0.1% to about 2%.

E. Aqueous Carrier

The compositions of the present invention include an aqueous carrier. The level and species
5 of the carrier are selected according to the compatibility with other components and other desired characteristic of the product.

Carriers useful in the present invention include water and water solutions of lower alkyl alcohols. Lower alkyl alcohols useful herein are monohydric alcohols having 1 to 6 carbons, more preferably ethanol and isopropanol.

10 Preferably, the aqueous carrier is substantially water. Deionized water is preferably used. Water from natural sources containing mineral cations can also be used, depending on the desired characteristic of the product. Generally, the compositions of the present invention comprise from about 20% to about 99%, preferably from about 40% to about 98%, and more preferably from about 60% to about 98% aqueous carrier.

15 The pH of the present composition is preferably from about 4 to about 9, more preferably from about 4.5 to about 7.5. Buffers and other pH adjusting agents can be included to achieve the desirable pH.

F. Optional Components

1. Microemulsified Conditioning Agents

20 The personal care compositions of the present invention may further comprise microemulsified conditioning agents. These include materials used to give a particular conditioning benefit to hair and/or skin. The conditioning agents useful in the personal care compositions of the present invention typically comprise a water insoluble, water dispersible, non-volatile, liquid that forms emulsified, liquid particles or are solubilized by the surfactant micelles,
25 in the anionic surfactant component. Suitable conditioning agents for use in the personal care composition are those conditioning agents characterized generally as silicone oils, organic conditioning oils (e.g. hydrocarbon oils, polyolefins, fatty esters, and fatty alcohols), fluorinated compounds, or combinations thereof, or those conditioning agents which otherwise form liquid, dispersed, particles in the aqueous surfactant matrix herein. Such conditioning agents should be
30 physically and chemically compatible with the essential components of the composition, and should not otherwise unduly impair product stability, aesthetics or performance.

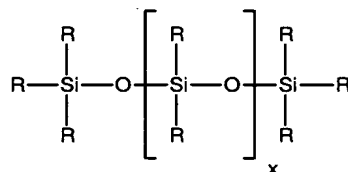
The concentration of the conditioning agent in the personal care composition should be sufficient to provide the desired conditioning benefits, as will be apparent to one of ordinary skill in the art. Such concentration can vary with the conditioning agent, the conditioning performance
35 desired, the average size of the conditioning agent particles, the type and concentration of other

components, and other like factors. The concentration of the conditioning agent may range from about 0.01 to about 10 weight percent and have a particle size of $\leq 80\text{nm}$, preferably $\leq 50\text{nm}$.

a. Silicone oils

Silicone oils are flowable silicone materials having a viscosity, as measured at 25°C , less than 1,000,000 csk, preferably from about 5 csk to about 1,000,000 csk, more preferably from about 10 csk to about 100,000 csk. Suitable silicone oils for use in the personal care compositions of the present invention include polyalkyl siloxanes, polyaryl siloxanes, polyalkylaryl siloxanes, polyether siloxane copolymers, and mixtures thereof. Other insoluble, non-volatile silicone fluids having hair conditioning properties may also be used.

Silicone oils include polyalkyl or polyaryl siloxanes which conform to the following Formula IV:



wherein R is aliphatic, preferably alkyl or alkenyl, or aryl, R can be substituted or unsubstituted, and x is an integer from 1 to about 8,000. Suitable unsubstituted R groups for use in the personal care compositions of the present invention include, but are not limited to: alkoxy, aryloxy, alkaryl, arylalkyl, arylalkenyl, alkamino, and ether-substituted, hydroxyl-substituted, and halogen-substituted aliphatic and aryl groups. Suitable R groups also include cationic amines and quaternary ammonium groups.

Preferred alkyl and alkenyl substituents are C_1 to C_5 alkyls and alkenyls, more preferably from C_1 to C_4 , more preferably from C_1 to C_2 . The aliphatic portions of other alkyl-, alkenyl-, or alkynyl-containing groups (such as alkoxy, alkaryl, and alkamino) can be straight or branched chains, and are preferably from C_1 to C_5 , more preferably from C_1 to C_4 , even more preferably from C_1 to C_3 , more preferably from C_1 to C_2 . As discussed above, the R substituents can also contain amino functionalities (e.g. alkamino groups), which can be primary, secondary or tertiary amines or quaternary ammonium. These include mono-, di- and tri- alkylamino and alkoxyamino groups, wherein the aliphatic portion chain length is described above.

b. Organic conditioning oils

The conditioning component of the personal care compositions of the present invention may also comprise from about 0.05% to about 3%, by weight of the composition, preferably from about 0.08% to about 1.5%, more preferably from about 0.1% to about 1%, of at least one organic

conditioning oil as the conditioning agent, either alone or in combination with other conditioning agents, such as the silicone oils (described above).

i. Hydrocarbon oils

Suitable organic conditioning oils for use as conditioning agents in the personal care compositions of the present invention include, but are not limited to, hydrocarbon oils having at least about 10 carbon atoms, such as cyclic hydrocarbons, straight chain aliphatic hydrocarbons (saturated or unsaturated), and branched chain aliphatic hydrocarbons (saturated or unsaturated), including polymers and mixtures thereof. Straight chain hydrocarbon oils preferably are from about C₁₂ to about C₁₉. Branched chain hydrocarbon oils, including hydrocarbon polymers, typically will contain more than 19 carbon atoms.

Specific non-limiting examples of these hydrocarbon oils include paraffin oil, mineral oil, saturated and unsaturated dodecane, saturated and unsaturated tridecane, saturated and unsaturated tetradecane, saturated and unsaturated pentadecane, saturated and unsaturated hexadecane, polybutene, polydecene, and mixtures thereof. Branched-chain isomers of these compounds, as well as of higher chain length hydrocarbons, can also be used, examples of which include highly branched, saturated or unsaturated, alkanes such as the permethyl-substituted isomers, e.g., the permethyl-substituted isomers of hexadecane and eicosane, such as 2, 2, 4, 4, 6, 6, 8, 8-dimethyl-10-methylundecane and 2, 2, 4, 4, 6, 6-dimethyl-8-methylnonane, available from Permethyl Corporation. Hydrocarbon polymers such as polybutene and polydecene. A preferred hydrocarbon polymer is polybutene, such as the copolymer of isobutylene and butene. A commercially available material of this type is L-14 polybutene from Amoco Chemical Corporation.

ii. Polyolefins

Organic conditioning oils for use in the personal care compositions of the present invention can also include liquid polyolefins, more preferably liquid poly- α -olefins, more preferably hydrogenated liquid poly- α -olefins. Polyolefins for use herein are prepared by polymerization of C₄ to about C₁₄ olefenic monomers, preferably from about C₆ to about C₁₂.

Non-limiting examples of olefenic monomers for use in preparing the polyolefin liquids herein include ethylene, propylene, 1-butene, 1-pentene, 1-hexene, 1-octene, 1-decene, 1-dodecene, 1-tetradecene, branched chain isomers such as 4-methyl-1-pentene, and mixtures thereof. Also suitable for preparing the polyolefin liquids are olefin-containing refinery feedstocks or effluents. Preferred hydrogenated α -olefin monomers include, but are not limited to: 1-hexene to 1-hexadecenes, 1-octene to 1-tetradecene, and mixtures thereof.

iii. Fatty Esters

Other suitable organic conditioning oils for use as the conditioning agent in the personal care compositions of the present invention include, but are not limited to, fatty esters having at least 10 carbon atoms. These fatty esters include esters with hydrocarbonyl chains derived from fatty acids or alcohols (e.g. mono-esters, polyhydric alcohol esters, and di- and tri-carboxylic acid esters). The hydrocarbonyl radicals of the fatty esters hereof may include or have covalently bonded thereto other compatible functionalities, such as amides and alkoxy moieties (e.g., ethoxy or ether linkages, etc.).

Specific examples of preferred fatty esters include, but are not limited to: isopropyl isostearate, hexyl laurate, isohexyl laurate, isohexyl palmitate, isopropyl palmitate, decyl oleate, isodecyl oleate, hexadecyl stearate, decyl stearate, isopropyl isostearate, dihexyldecyl adipate, lauryl lactate, myristyl lactate, cetyl lactate, oleyl stearate, oleyl oleate, oleyl myristate, lauryl acetate, cetyl propionate, and oleyl adipate.

Other fatty esters suitable for use in the personal care compositions of the present invention are mono-carboxylic acid esters of the general formula $R'COOR$, wherein R' and R are alkyl or alkenyl radicals, and the sum of carbon atoms in R' and R is at least 10, preferably at least 22.

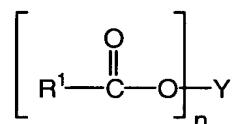
Still other fatty esters suitable for use in the personal care compositions of the present invention are di- and tri-alkyl and alkenyl esters of carboxylic acids, such as esters of C_4 to C_8 dicarboxylic acids (e.g. C_1 to C_{22} esters, preferably C_1 to C_6 , of succinic acid, glutaric acid, adipic acid,). Specific non-limiting examples of di- and tri- alkyl and alkenyl esters of carboxylic acids include isocetyl stearyl stearate, diisopropyl adipate, and tristearyl citrate.

Other fatty esters suitable for use in the personal care compositions of the present invention are those known as polyhydric alcohol esters. Such polyhydric alcohol esters include alkylene glycol esters, such as ethylene glycol mono and di-fatty acid esters, diethylene glycol mono- and di-fatty acid esters, polyethylene glycol mono- and di-fatty acid esters, propylene glycol mono- and di-fatty acid esters, polypropylene glycol monooleate, polypropylene glycol monostearate, ethoxylated propylene glycol monostearate, glyceryl mono- and di-fatty acid esters, polyglycerol poly-fatty acid esters, ethoxylated glyceryl monostearate, 1,3-butylene glycol monostearate, 1,3-butylene glycol distearate, polyoxyethylene polyol fatty acid ester, sorbitan fatty acid esters, and polyoxyethylene sorbitan fatty acid esters.

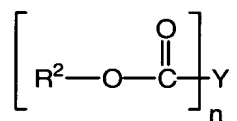
Still other fatty esters suitable for use in the personal care compositions of the present invention are glycerides, including, but not limited to, mono-, di-, and tri-glycerides, preferably di- and tri-glycerides, more preferably triglycerides. For use in the personal care compositions described herein, the glycerides are preferably the mono-, di-, and tri-esters of glycerol and long

chain carboxylic acids, such as C₁₀ to C₂₂ carboxylic acids. A variety of these types of materials can be obtained from vegetable and animal fats and oils, such as castor oil, safflower oil, cottonseed oil, corn oil, olive oil, cod liver oil, almond oil, avocado oil, palm oil, sesame oil, lanolin and soybean oil. Synthetic oils include, but are not limited to, triolein and tristearin glyceryl dilaurate.

Other fatty esters suitable for use in the personal care compositions of the present invention are water insoluble synthetic fatty esters. Some preferred synthetic esters conform to the general Formula V:



wherein R¹ is a C₇ to C₉ alkyl, alkenyl, hydroxyalkyl or hydroxyalkenyl group, preferably a saturated alkyl group, more preferably a saturated, linear, alkyl group; n is a positive integer having a value from 2 to 4, preferably 3; and Y is an alkyl, alkenyl, hydroxy or carboxy substituted alkyl or alkenyl, having from about 2 to about 20 carbon atoms, preferably from about 3 to about 14 carbon atoms. Other preferred synthetic esters conform to the general Formula VI:



wherein R² is a C₈ to C₁₀ alkyl, alkenyl, hydroxyalkyl or hydroxyalkenyl group; preferably a saturated alkyl group, more preferably a saturated, linear, alkyl group; n and Y are as defined above in Formula V.

Specific non-limiting examples of suitable synthetic fatty esters for use in the personal care compositions of the present invention include: P-43 (C₈-C₁₀ triester of trimethylolpropane), MCP-684 (tetraester of 3,3 diethanol-1,5 pentadiol), MCP 121 (C₈-C₁₀ diester of adipic acid), all of which are available from Mobil Chemical Company.

c. Fluorinated Compounds

Fluorinated compounds suitable for delivering conditioning to hair or skin consistent with the present invention include perfluoropolyethers, perfluorinated olefins, fluorine based specialty polymers that may be in a fluid or elastomer form similar to the silicone fluids previously described, and perfluorinated dimethicones. Specific non-limiting examples of suitable fluorinated compounds include the Fomblin product line from Ausimont which include HC/04, HC/25, HC01, HC/02, HC/03; Dioctyldodecyl Fluoroethyl Citrate, commonly called Biosil Basics Fluoro Gerbet 3.5 supplied by Biosil Technologies; and Biosil Basics Fluorosil LF also supplied by Biosil Technologies.

2. Dispersed, Water Insoluble Particles

One embodiment of the present invention comprises dispersed, water insoluble particles. Particles useful in the present invention can be inorganic, synthetic, or semi-synthetic in composition.

5 Non limiting examples of inorganic particles include various silica particles including colloidal silicas, fumed silicas, precipitated silicas and silica gels. Non-limiting examples of colloidal silicas include Snowtex C, Snowtex O, Snowtex 50, Snowtex OL, Snowtex ZL available from Nissan Chemical America Corporation and colloidal silicas sold under the tradename Ludox available from W.R. Grace & Co. Non-limiting examples of fumed silicas include hydrophillic and hydrophobic forms available as Aerosil 130, Aerosil 200, Aerosil 300, Aerosil R972 and Aerosil R812 available from Degussa Corp. and those available from Cabot Corp. under the trade name Cab-O-Sil including Cab-O-Sil M-5, HS-5, TS-530, TS-610, and TS-720. Non-limiting examples of precipitated silicas include those available in both hydrophillic and hydrophobic versions from Degussa Corp. under the trade name Sipernat including Sipernat 350, 360, 22LS, 22S, 320, 50S, D10, D11, D17, and C630; those sold by W. R. Grace & Co. under the trade name Syloid, those sold by the J.M. Huber Corp. under the tradename Zeothix and Zeodent, and those available from Rhodia under the trade name Tixosil. Also useful in the present invention are spherical silica particles available in various particle sizes and porosities. Non limiting examples of spherical silica particles include MSS-500/H, MSS-500/3H, MSS-500, MSS-500/3, MSS-500/N and MSS-500/3N available from KOBO Products Inc.; those available from Presperse Inc. under the trade name Spheron including Spheron P-1500 and L-1500, and those available from Sunjin Chemical Co. under the trade name Sunsil including Sunsil 20, 20L, 20H, 50L, 50, 50H, 130L, 130 and 130H. Other non-limiting examples of inorganic particles useful in the present invention include various silicates including magnesium silicate such as those available from 3M under the trade name CM-111 Cosmetic Microspheres, glass particles such as those available from Nippon Paint Corp. under the trade name GlamurGlo Glass Chips and PrizmaLite Glass Spheres; talcs, micas, sericites, and various natural and synthetic clays including bentonites, hectorites, and montmorillonites.

Examples of synthetic particles include nylon, silicone resins, poly(meth)acrylates, polyethylene, polyester, polypropylene, polystyrene, polyurethane, polyamide, epoxy resins, urea resins, and acrylic powders. Non limiting examples of useful particles are Microease 110S, 114S, 116 (micronized synthetic waxes), Micropoly 210, 250S (micronized polyethylene), Microslip (micronized polytetrafluoroethylene), and Microsilk (combination of polyethylene and polytetrafluoroethylene), all of which are available from Micro Powder, Inc. Other examples include MP-2200, BPA-500 (polymethylmethacrylate), EA-209 (ethylene/acrylate copolymer),

SP-501(nylon-12), SP-10 (nylon-12), ES-830 (polymethly methacrylate), BPD-800, BPD-500, BPA-500 (polyurethane), and CL2080 (polyethylene) particles available from Kobo Products, Inc., spherical polyethylenes available from Quantum Chemical under the trade name Microthene including MN701, MN710, MN-714, MN-722 and FN5100, nylon particles available from Elf Atochem under the trade name Orgasol, acrylates copolymers available from Advanced Polymer Systems under the trade name Microsponge and Polytrap, and silicone resins sold under the name Tospearl particles by GE Silicones. Ganzpearl GS-0605 crosslinked polystyrene (available from Presperse) is also useful.

Non limiting examples of hybrid particles include Ganzpearl GSC-30SR (Sericite & crosslinked polystyrene hybrid powder), and SM-1000, SM-200 (mica and silica hybrid powder available from Presperse).

Particles comprised of polymers and copolymers obtained from esters, such as, for example, vinyl acetate or lactate, or acids, such as, for example, itaconic, citraconic, maleic or fumaric acids may also be used. See, in this regard, Japanese Patent Application No. JP-A-2-112304, the full disclosure of which is incorporated herein by reference.

3. Suspending agent

The personal care compositions of the present invention may further comprise a suspending agent at concentrations effective for suspending the water-insoluble, dispersed material in the personal care compositions. Such concentrations range from about 0.1% to about 10%, preferably from about 0.3% to about 5.0%, by weight of the personal care compositions.

Suitable suspending agents include crystalline suspending agents that can be categorized as acyl derivatives, long chain amine oxides, or combinations thereof. These suspending agents are described in U.S. Patent 4,741,855, which description is incorporated herein by reference.

4. Anti-dandruff Actives

The compositions of the present invention may also contain an anti-dandruff agent. Suitable, non-limiting examples of anti-dandruff particulates include: pyridinethione salts, azoles, selenium sulfide, particulate sulfur, and mixtures thereof. Preferred are pyridinethione salts. Such anti-dandruff particulate should be physically and chemically compatible with the essential components of the composition, and should not otherwise unduly impair product stability, aesthetics or performance. These anti-dandruff actives are described in WO01/00151 which description is incorporated herein by reference.

5. Humectant

The compositions of the present invention may contain a humectant. The humectants herein are selected from the group consisting of polyhydric alcohols, water soluble alkoxylated

nonionic polymers, and mixtures thereof. The humectants, when used herein, are preferably used at levels by weight of the composition of from about 0.1% to about 20%, more preferably from about 0.5% to about 5%.

5 Polyhydric alcohols useful herein include glycerin, sorbitol, propylene glycol, butylene glycol, hexylene glycol, ethoxylated glucose, 1, 2-hexane diol, hexanetriol, dipropylene glycol, erythritol, trehalose, diglycerin, xylitol, maltitol, maltose, glucose, fructose, sodium chondroitin sulfate, sodium hyaluronate, sodium adenosine phosphate, sodium lactate, pyrrolidone carbonate, glucosamine, cyclodextrin, and mixtures thereof.

10 Water soluble alkoxylated nonionic polymers useful herein include polyethylene glycols and polypropylene glycols having a molecular weight of up to about 1000 such as those with CTFA names PEG-200, PEG-400, PEG-600, PEG-1000, and mixtures thereof.

6. Other Optional Components

The compositions of the present invention may contain fragrance.

15 The compositions of the present invention may also contain vitamins and amino acids such as: water soluble vitamins such as vitamin B1, B2, B6, B12, C, pantothenic acid, pantothenyl ethyl ether, panthenol, biotin, and their derivatives, water soluble amino acids such as asparagine, alanin, indole, glutamic acid and their salts, water insoluble vitamins such as vitamin A, D, E, and their derivatives, water insoluble amino acids such as tyrosine, tryptamine, and their salts.

20 The compositions of the present invention may also contain pigment materials such as inorganic, nitroso, monoazo, disazo, carotenoid, triphenyl methane, triaryl methane, xanthene, quinoline, oxazine, azine, anthraquinone, indigoid, thionindigoid, quinacridone, phthalocianine, botanical, natural colors, including: water soluble components such as those having C. I. Names.

25 The compositions of the present invention may also contain antimicrobial agents which are useful as cosmetic biocides and antidandruff agents including: water soluble components such as piroctone olamine, water insoluble components such as 3,4,4'- trichlorocarbanilide (trichlosan), triclocarban and zinc pyrithione. The compositions of the present invention may also contain chelating agents.

METHOD OF MAKING

30 The compositions of the present invention, in general, may be made by mixing the ingredients together at either room temperature or at elevated temperature, e.g., about 72.degree. C. Heat only needs to be used if solid ingredients are in the composition. The ingredients are mixed at the batch processing temperature. Additional ingredients, including electrolytes, 35 polymers, and particles, may be added to the product at room temperature.

METHOD OF USE

The personal care compositions of the present invention are used in a conventional manner for cleansing and conditioning hair or skin. An effective amount of the composition for cleansing and conditioning the hair or skin is applied to the hair or skin, that has preferably been wetted with water, and then rinsed off. Such effective amounts generally range from about 1gm to about 50gm, preferably from about 1gm to about 20gm. Application to the hair typically includes working the composition through the hair such that most or all of the hair is contacted with the composition.

This method for cleansing and conditioning the hair or skin comprises the steps of:

a) wetting the hair or skin with water, b) applying an effective amount of the personal care composition to the hair or skin, and c) rinsing the applied areas of skin or hair with water. These steps can be repeated as many times as desired to achieve the desired cleansing and conditioning benefit.

NON-LIMITING EXAMPLES

The compositions illustrated in the following Examples illustrate specific embodiments of the compositions of the present invention, but are not intended to be limiting thereof. Other modifications can be undertaken by the skilled artisan without departing from the spirit and scope of this invention. These exemplified embodiments of the composition of the present invention provide enhanced deposition of the personal care composition due to enhanced coacervate formation.

The compositions illustrated in the following Examples are prepared by conventional formulation and mixing methods, an example of which is described above. All exemplified amounts are listed as weight percents and exclude minor materials such as diluents, preservatives, color solutions, imagery ingredients, botanicals, and so forth, unless otherwise specified.

The following are representative of Clear Shampoo compositions (shampoo compositions with a %Transmittance $\geq 70\%$) of the present invention:

Ingredient	Examples, wt%							
	1	2	3	4	5	6	7	8
Water	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.
Polyquaterium 10 ¹	0.25	0.25	0.25					0.25
Polyquaterium 10 ²				0.50				
Polyquaterium 10 ³					0.50			
Cationic Cellulose						0.50		

Polymer A ⁴								
Cationic Cellulose Polymer B ⁵							0.50	
Sodium Laureth Sulfate (SLE3S –29% active) ⁶	34.48	41.38	41.38	48.28	34.48	34.48	31.03	34.48
Sodium Lauryl Sulfate (SLS – 29% active) ⁷	13.79	6.9	6.9	10.35	13.79	13.79	13.79	13.79
Dimethicone Microemulsion ⁸	1.0	-	1.0	2.0	2.0	2.0	2.0	
TEA Dodecyl Benzene Sulfonate ⁹								0.45
POE Lauryl Ether ¹⁰								0.1
Disodium Coco Amphodiacetate ¹¹	4.44	4.44	4.44					4.44
PPG-2 Hydroxyethyl Coco/Isostearamide ¹²	2	2	2	2	2	2	2	2
Magnesium Chloride, hexahydrate ¹³	0.5	0.5	0.5					0.5
Sodium Chloride ¹⁴	0.5	0.5	0.5	0.1	1.0	1.0	1.0	0.5
Fragrance	0.55	0.55	0.55	0.5	0.5	0.5	0.75	0.55
Preservatives, pH adjusters	Up to 1%	Up to 1%	Up to 1%	Up to 1%	Up to 1%	Up to 1%	Up to 1%	Up to 1%
Calculated:								
Ethoxylate level	2.94	3.53	3.53	4.12	2.94	2.94	2.65	2.94
Sulfate level	2.95	2.95	2.95	3.4	2.95	2.95	2.76	2.95

- 1 UCare Polymer JR30M, MW=2.0 MM, charge density = 1.32 meq./gram, supplier Dow Chemicals
- 2 UCare Polymer KG30M, MW= 2.0MM, charge density =1.96 meq./gram, supplier Dow Chemicals
- 3 UCare Polymer LR30M, MW= 1.8MM, charge density = 0.71 meq/grams, supplier Dow Chemicals
- 4 Cationic Cellulose polymer with MW = 2.0 MM and charge density = 0.7
- 5 Cationic Cellulose polymer with MW= 1.0 MM and charge density = 1.29
- 6 Sodium Laureth Sulfate at 29% active with an average of approximately 3 moles of ethoxylation, supplier: P&G
- 7 Sodium Lauryl Sulfate at 29% active, supplier: P&G
- 8 DC2-1870, 30nm particle size dimethicone using TEA dodecyl benzene sulfonate and POE lauryl ether as primary surfactants, supplier Dow Corning.
- 9 Biosoft N-300 (60% active), supplier Stepan
- 10 BRIJ 35, Supplier Unichema
- 11 Schercoteric MS-2 at 45% active, supplier Scher Chemicals
- 12 Promidium 2, supplier Unichema
- 13 Magnesium Chloride 6-Hexahydrate, supplier Fisher Chemicals
- 14 Sodium Chloride USP (food grade), supplier Morton.

The following are representative of Shampoo compositions of the present invention:

Ingredient	Examples, wt%				
	9	10	11	12	13
Water	q.s.	q.s.	q.s.	q.s.	q.s.
Polymer LR30M ¹		0.25			
Polymer JR30M ²					0.5
Polymer KG30M ³	0.5		0.5		
Cationic Cellulose Polymer ⁴				0.5	
Sodium Laureth Sulfate (SLE3) ⁵	51.72		37.93		34.48
Sodium Laureth Sulfate(SLE2S) ⁶				48.3	
Sodium Lauryl Sulfate ⁷	17.24		10.35		13.34
Ammonium Laureth Sulfate (ALE3S) ⁸		30.11			
Ammonium Lauryl Sulfate ⁹		6.8			
Silicone Microemulsion ¹⁰	2.0	2.0			
Octadodecyl Stearate ¹¹			0.5		
Cetyl Alcohol ¹²					0.5
TEA Dodecyl Benzene Sulfonate ¹³			0.5		
POE Lauryl Ether ¹⁴			0.25		
Cocoamodopropyl Betaine ¹⁵				2.0	
Sodium Coco Amphoacetate ¹⁶				2.0	4.44
Cocamide MEA ¹⁷		0.94			
PPG-2 Hydroxyethyl Coco/Isostearamide ¹⁸			3		3
Sodium Chloride ¹⁹	0.5	1.5	1.0	1.0	1.2
Fragrance	0.55	0.55	0.75	0.5	0.5
Preservatives, pH adjusters	<1.0	<1.0	<1.0	<1.0	<1.0
Calculated levels based on surfactants added above:					
Ethoxylate level	4.41	2.2	3.24	3.12	2.94
Sulfate level	4.16	1.9	2.87	2.90	2.92

- 1 Ucare Polymer LR30M, MW= 1.8MM, charge density = 0.71 meq/grams, supplier Dow Chemicals
- 2 UCare Polymer JR30M, MW=2.0 MM, charge density = 1.32 meq./gram, supplier Dow Chemicals
- 3 UCare Polymer KG30M, MW= 2.0MM, charge density =1.96 meq./gram, supplier Dow Chemicals
- 4 Cationic Cellulose polymer with MW = 2.0 MM and charge density = 0.7
- 5 Sodium Laureth Sulfate at 29% active with an average of approximately 3 moles of ethoxylation, supplier: P&G
- 6 Sodium Laureth Sulfate at 29% active with an average of approximately 2 moles of ethoxylation, supplier: P&G
- 7 Sodium Lauryl Sulfate at 29% active, supplier: P&G
- 8 Ammonium Laueth Sulfate. 25% active with 3 moles of ethoxylation, supplier: P&G
- 9 Ammonium Lauryl Sulfate, 25% active, supplier: P&G
- 10 DC2-1550, 44 nm particle size dimethicone using TEA dodecyl benzene sulfonate and POE lauryl ether as primary surfactants, supplier Dow Corning.
- 11 Ceraphyl ODS, supplier: ISP

- 12 CO-1695, supplier P&G
- 13 Biosoft N-300 (60% active), supplier Steppan
- 14 BRIJ 35, Supplier Unichema
- 15 Tegobetaine (30% active), supplier Goldschmidt (Degussa)
- 16 Schercoteric MS at 50% active, supplier Scher Chemicals, Inc.
- 17 Monamide CMA, supplier Unichema
- 18 Promidium 2, supplier Unichema
- 19 Sodium Chloride USP (food grade), supplier Morton.

Examples 14, 16 and 17 are additional highly preferred examples. Example 15 is very similar in composition to example 14, but has a different surfactant ethoxylate value. Example 15 has a calculated ethoxylate value below the claimed range and performs poorly with respect to coacervate formation. Example 18, likewise has a similar composition to the highly preferred example 16, but has a different surfactant ethoxylate value, again below the preferred range. Example 18 has poor coacervate formation and is not a preferred composition. These examples highlight the importance of ethoxylate ratio and demonstrate that relatively small changes in ethoxylate value have an unexpectedly dramatic impact on coacervate amount. This observation by the present inventors that only very specific ethoxylate values yield optimum coacervate amount and moreover the dependence of this value on the polymer molecular weight is novel with respect to the known art which often fails to identify any specific ethoxylate values or equivalent (such as precise levels and ratios of ethoxylated surfactant).

Ingredient	Examples, wt%				
	14	15	16	17	18
Water	q.s.	q.s.	q.s.	q.s.	q.s.
Polymer LR30M ¹	0.25	0.25			
Polymer KG30M ²			0.25	0.25	0.25
Sodium Laureth Sulfate (SLE3) ³			51.73		
Sodium Lauryl Sulfate ⁴			17.244		
Ammonium Laureth Sulfate (ALE3S) ⁵	57.2	40.0		60.0	40.0
Ammonium Lauryl Sulfate ⁶	6.8	28.0		20.0	28.0
Silicone Microemulsion ⁷	2.0	2.0	2.0	1.0	2.0
Cocamide MEA ⁸	0.94	0.94	0.94	0.94	0.94
Sodium Chloride ⁹	1.3	1.3	0.50		
Ammonium Chloride ¹⁰				0.29	0.20
AXS ¹¹				0.5	
Fragrance	0.55	0.55	0.55	0.55	0.55
Preservatives, pH adjusters	<1.0	<1.0	<1.0	<1.0	<1.0
Calculated levels based on surfactants added above:					
Ethoxylate level	4.21	2.95	4.41	4.41	2.94
Sulfate level	3.15	3.75	4.16	4.16	3.75
Coacervate % ¹²	9.0	4.5	25.0	8.6	3.0

- 1 Ucare Polymer LR30M, MW= 1.8MM, charge density = 0.71 meq/grams, supplier Dow Chemicals
- 2 UCare Polymer KG30M, MW= 2.0MM, charge density =1.96 meq./gram, supplier Dow Chemicals
- 3 Sodium Laureth Sulfate at 29% active with an average of approximately 3 moles of ethoxylation, supplier: P&G
- 4 Sodium Lauryl Sulfate at 29% active, supplier: P&G
- 5 Ammonium Laueth Sulfate. 25% active with 3 moles of ethoxylation, supplier: P&G
- 6 Ammonium Lauryl Sulfate, 25% active, supplier: P&G
- 7 DC2-1550, 44 nm particle size dimethicone using TEA dodecyl benzene sulfonate and POE lauryl ether as primary surfactants, supplier Dow Corning.
- 8 Monamide CMA, supplier Unichema
- 9 Sodium Chloride USP (food grade), supplier Morton.
- 10 Ammonium Chloride, supplier P&G.
- 11 Ammonium Xylene Sulphate, supplier Stepan
- 12 Calculated via the coacervate centrifuge method – described herein

The following are representative of Body Wash compositions of the present invention.

5

Ingredient	Example, wt%			
	19	20	21	22
Water	q.s.	q.s.	q.s.	q.s.
Polymer JR30M ¹	0.5			
Polymer KG30M ²		0.5	0.5	0.5
Sodium Laureth Sulfate (SLE3) ³	41.38	41.38	50.0	41.38
Sodium Lauryl Sulfate ⁴	6.9	13.79	10.0	13.79
Silicone Microemulsion ⁵	2.0		1.0	
Cetyl Alcohol ⁶		0.5		
Disodium Laureth Sulfosuccinate ⁷	1.0			
Glycerine ⁸	1.0		2.0	
Cocoamidopropyl Betaine ⁹	3.0			
Disodium Coco Amphodiacetate ¹⁰		4.44	1.0	4.44
Decyl Glucoside ¹¹		1.0		
Glyceryl Stearate, Cetearyl Alcohol, Stearic Acid, 1-Propanamimium-3-Amino-N-(2-hydroxyethyl)N,N-Dimethyl-N-C16-18 Acryl Derivs., Chlorides ¹²			0.5	
Perfluoropolymethylisopropyl Ether ¹⁴				1.0
Magnesium Chloride, hexahydrate ¹⁵	0.5			
Sodium Chloride ¹⁶	0.55	0.6	1.0	0.6
Fragrance	0.55	0.55	0.55	0.55
Preservatives, pH adjusters	<1.0	<1.0	<1.0	<1.0
Calculated levels based on surfactants added above:				
Ethoxylate level	3.53	3.53	4.27	3.53
Sulfate level	2.79	3.33	3.50	3.33

- 1 UCare Polymer JR30M, MW=2.0 MM, charge density = 1.32 meq./gram, supplier
Dow Chemicals
- 2 UCare Polymer KG30M, MW= 2.0MM, charge density =1.96 meq./gram, supplier
Dow Chemicals
- 3 Sodium Laureth Sulfate at 29% active with an average of approximately 3 moles of
ethoxylation, supplier: P&G
- 4 Sodium Lauryl Sulfate at 29% active, supplier: P&G
- 5 DC2-1870, 30nm particle size dimethicone using TEA dodecyl benzene sulfonate and
POE lauryl ether as primary surfactants, supplier Dow Corning.
- 6 CO-1695, supplier P&G
- 7 Stepan-MILD LSB, supplier Stepan
- 8 Star, supplier: Procter & Gamble
- 9 Tegobetaine (30% active), supplier Goldschmidt (Degussa)
- 10 Schercoteric MS-2 at 45% active, supplier Scher Chemicals, Inc.
- 11 Plantaren PS-100, supplier Cognis Care Chemicals
- 12 Prolipid 151, supplier ISP
- 13 Promidium 2, supplier Unichema
- 14 Fomblin HC/04, supplier Ausimont
- 15 Magnesium Chloride 6-Hexahydrate, supplier Fisher Chemicals
- 16 Sodium Chloride USP (food grade), supplier Morton.

All documents cited in the Detailed Description of the Invention are, in relevant part,
incorporated herein by reference; the citation of any document is not to be construed as an
5 admission that it is prior art with respect to the present invention.

While particular embodiments of the present invention have been illustrated and
described, it would be obvious to those skilled in the art that various other changes and
modifications can be made without departing from the spirit and scope of the invention. It is,
therefore, intended to cover in the appended claims all such changes and modifications that are
10 within the scope of this invention.